

PATENT ABSTRACTS OF JAPAN

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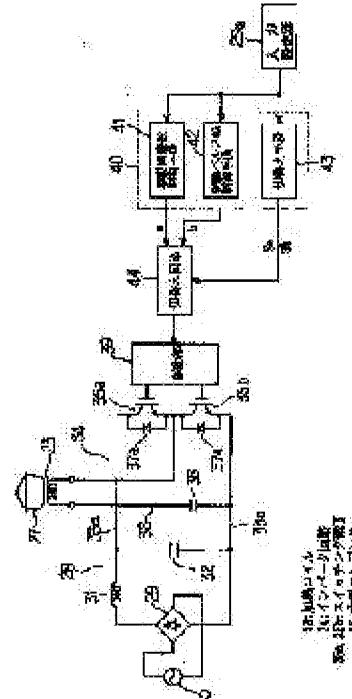
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(54) INVERTER COOKER

(57)Abstract:

PROBLEM TO BE SOLVED: To allow input to be continuously variable from high to low without causing an excessive rise in driving frequency or passage of a short circuit current.

SOLUTION: An inverter circuit 34 comprises a heating coil 23, a resonant capacitor 36, and IGBTs 35a, 35b. The inverter circuit 34 generates high-frequency power based on switch-driving of the IGBTs 35a, 35b. A driving frequency control means 41 controls the driving frequency of the IGBTs 35a, 35b. A driving pulse width control means 42 controls the driving pulse width of the IGBTs 35a, 35b. Input is thereby adjusted by the control means 41 and 42.



DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the inverter cooking device provided with the bridge type inverter circuit.

[0002]

[Problem(s) to be Solved by the Invention] The induction heating cooker which is an inverter cooking device is shown in drawing 25. In the figure, DC power supply circuit 1 is provided with the commercial alternating current power 2 of 100V, and smooth, and the reactor 4 and the capacitor 5 for rectifying, generating DC power supply and being as smooth as the diode bridge 3 for rectification are constituted, for example in it. Said reactor 4 also has the function to stop a noise.

[0003] The inverter circuit 6 has the heating coil 7, the capacitor 8 for resonance, and the switching elements 9 and 10, and is constituted, and antiparallel connection of the free wheel diodes 11 and 12 is carried out to each switching elements 9 and 10. As the actuator 13 is turned on and off and it is shown in drawing 26, by placing a dead time and making it turn on and off by turns, the above-mentioned switching elements 9 and 10 send the high frequency current through the heating coil 7, and carry out induction heating of the pan 14.

[0004] It is the composition that input adjustment is usually continuously performed between input power 400W-3kW in the induction heating cooker mentioned above by changing the drive frequency (on-off frequency) of the switching elements 9 and 10 of the above-mentioned inverter circuit 6. In less than the input power's 400w carrying out,

he is trying to operate the inverter circuit 6 intermittently, but there is fault to which heating is intermittent and there is a request of liking to adjust an input continuously from a high input to a low input.

[0005]Here, in order to adjust input power to less than 400W by continuation adjustment by drive frequency change, the drive frequency of the switching elements 9 and 10 becomes high too much, now, switching loss increases, a cooling system is enlarged, and it is not practical.

[0006]Then, if it is a method which makes one duty ratio small uniquely and changes the drive frequency of the switching elements (driving pulse width is relatively made small) 9 and 10 from a high input to a low input, input power does not have to make drive frequency the high frequency of 100 kHz even about 50W.

[0007]However, when the one [in a high input field / the switching element 10 of a lower arm] in this case conversely, When one [the up-and-down short circuit between the reverse recovery time of the free wheel diode 11 of an upper arm (while the free wheel diode has reverse-flowed) occurs and / the switching element 9 of an upper arm], the up-and-down short circuit between the reverse recovery time of the free wheel diode 12 of a lower arm occurs. For this reason, an inverter loss increases and a noise occurs according to a short-circuit current.

[0008]Although drawing 27 can consider the composition which forms the snubber circuit 15 provided with the snubber capacitor 15a for the above-mentioned noise prevention, in continuation adjustment of the drive frequency in fixed duty ratio, a short-circuit current occurs like **** also in this case. Each switching element 9, the situation of switching of ten, and the situation of current that flows into the inverter circuit 6 are

divided into mode (a) - (j), and is shown in drawing 28. The relation between each switching element 9, the situation (base voltage VGE1, VGE2) of turning on and off of ten, current IL and current Ic1, and collector-to-emitter-voltage VCE2 of the switching element 10 is shown in drawing 29. Timing a-j of this drawing 29 has agreed to the timing of each above-mentioned mode (a) - (j).

[0009]If an input (input current IL) becomes large, when shifting to the mode (j) from mode (i), charging current flows into the snubber capacitor 15a, since the one [the switching element 9] while voltage falling, a big short-circuit current flows, and there is a possibility of destroying this switching element 9.

[0010]When shifting to the mode (e) from the mode (d), charging current flows into the snubber capacitor 15a, since one [the switching element 10] as voltage is rising, a big short-circuit current flows, and there is a possibility of destroying this switching element 10. Although there is also a method which changes only driving pulse width without changing drive frequency, it cannot cover from a high input to a low input in this case.

[0011]In change control of drive frequency, the oscillating frequency of the inverter circuit 6 may exceed a preset value on the characteristic of the circuit, the resonant circuit in the inverter circuit 6 might change from inductivity capacitive, and the loss of the circuit might increase.

[0012]This invention is made in light of the above-mentioned circumstances, and the purpose is in providing the inverter cooking device which can carry out continuation variable from a high input to a low input, without drive frequency's becoming high too much, or a short-circuit current flowing.

[0013] Means for Solving the Problem]A bridge type inverter circuit which generates high-frequency power based on an invention of claim 1 having a heating coil or a high frequency transformer, a capacitor for resonance, and a switching element, and carrying out switching driving of this switching element, It has a drive frequency control means which controls drive frequency of said switching element, and a driving-pulse-width control means which controls driving pulse width of said switching element, and has the feature at a place which was made to perform input adjustment by said drive frequency control means and a driving-pulse-width control means.

[0014]Input power is changed by input setting, or changes with loads. In this case, if it is going to change an input only by adjustment of drive frequency in fixed duty ratio, frequency will become high too much, it will be sufficient, and a short-circuit current will flow. However, in an invention of this claim 1, since said drive frequency control means and a driving-pulse-width control means perform input adjustment, it becomes possible to change an input continuously from a low area to a high area, without a short-circuit current occurring without frequency becoming high too much.

[0015]An invention of claim 2 has the feature at a place in which one or more snubber circuits were established to two or more switching elements of an inverter circuit. In this, without a short-circuit current occurring, a standup of voltage of a switching element can be eased by a snubber circuit, switching loss can be suppressed, and it can contribute to improve efficiency.

[0016]An invention of claim 3 has the feature at a place which performs input adjustment in a high input field by drive frequency control by a drive frequency control means, and was made to perform it by driving-pulse-width control according input

adjustment in a low input area to a driving-pulse-width control means. In this, since drive frequency control will take charge of a high input field, unlike a case where it takes charge from a high input field to a low input area, it can change an input in a high input field continuously good, without generating a short-circuit current. Since a low input area is taken charge of by driving-pulse-width control, an input can be lowered continuously and it is not necessary to make drive frequency high in this case by making it small one by one from proper driving pulse width.

[0017]An invention of claim 4 performs input adjustment in a high input field by drive frequency control by a drive frequency control means, It has the feature at a place which was made to perform input adjustment in a low input area by driving-pulse-width control by a driving-pulse-width control means, and drive frequency control by a drive frequency control means. According to this, since input adjustment in a high input field is taken charge of by drive frequency control, unlike a case where it takes charge from a high input field to a low input area, an input in a high input field can be changed continuously good, without generating a short-circuit current. Since not only driving-pulse-width control but drive frequency control performs input adjustment in a low input area, if drive frequency is set up according to driving pulse width, fine control will be attained without making frequency high.

[0018]An invention of claim 5 performs input adjustment in a high input field by driving-pulse-width control by a driving-pulse-width control means, and drive frequency control by a drive frequency control means, It has the feature at a place which was made to perform input adjustment in a low input area by driving-pulse-width control by a driving-pulse-width control means.

[0019]It becomes possible to perform still finer input adjustment control, without according to the invention of this claim 5, generating a short-circuit current in a high input field, since input adjustment in a high input field is performed not only by drive frequency control but by driving-pulse-width control. Since a low input area is taken charge of by driving-pulse-width control, an input can be lowered continuously and it is not necessary to make drive frequency high in this case by making it small one by one from proper driving pulse width.

[0020]An invention of claim 6 performs input adjustment in a high input field by driving-pulse-width control by a driving-pulse-width control means, and drive frequency control by a drive frequency control means, It has the feature at a place which was made to perform input adjustment in a low input area by drive frequency control by a drive frequency control means.

[0021]It becomes possible to perform still finer input adjustment control, without according to the invention of this claim 6, generating a short-circuit current in a high input field, since input adjustment in a high input field is taken charge of by driving-pulse-width control and drive frequency control is also performed in addition to this. And since input adjustment in a low input area is taken charge of by drive frequency control, an input can be continuously lowered by setting driving pulse width as duty ratio which does not become large, and raising drive frequency, without making frequency high.

[0022]It has the feature at a place which performs an invention of claim 7 by driving-pulse-width control according input adjustment in a high input field to a driving-pulse-width control means, and was made to perform input adjustment in a low input area by drive frequency control by a drive frequency control means.

[0023]Since input adjustment in a high input field is taken charge of by driving-pulse-width control according to the invention of this claim 7, unlike a case where from a high input field to a low input area is performed by driving-pulse-width control, input adjustment in a high input field by impossible pulse width which is not can be performed. Unlike a case where drive frequency control of it is carried out from a high input field to a low input area since input adjustment in a low input area is taken charge of by drive frequency control, it can be set as duty ratio according to a low input area, drive frequency can be changed, and an input can be lowered, without making drive frequency high. Since drive frequency control by duty ratio suitable for such a low input area is not performed in a high input field, a short circuit does not occur in an inverter circuit.

[0024]An invention of claim 8 performs input adjustment in a high input field by driving-pulse-width control by a driving-pulse-width control means, and input adjustment in a low input area, It has the feature at a place which was made to perform by driving-pulse-width control by a driving-pulse-width control means, and drive frequency control by a drive frequency control means.

[0025]Since input adjustment in a high input field is taken charge of by driving-pulse-width control according to the invention of this claim 8, unlike a case where from a high input field to a low input area is performed by driving-pulse-width control, input adjustment in a high input field by impossible pulse width which is not can be performed. If driving-pulse-width control can also mainly perform drive frequency control for input adjustment in a low input area and driving pulse width is set up according to drive frequency, fine control will be attained without making frequency high.

[0026]An invention of claim 9 has the feature at a place which performs a change to drive frequency control of a drive frequency control means, and driving-pulse-width control of a driving-pulse-width control means since operation of an inverter circuit is stopped. Since operation of an inverter circuit changes suddenly when changing drive frequency control of a drive frequency control means, and driving-pulse-width control of a driving-pulse-width control means, there is a possibility that switching element voltage may turn into excess voltage under influence of inductance, and an inverter circuit may be damaged. However, since according to the invention of this claim 9 operation of an inverter circuit is stopped and the above-mentioned change is performed, fear of breakage disappears.

[0027]An invention of claim 10 has the feature at a place which performs a change to drive frequency control of a drive frequency control means, and driving-pulse-width control of a driving-pulse-width control means, when a short-circuit current detection means to detect a short-circuit current of an inverter circuit is formed and a short-circuit current is detected by this short-circuit current detection means. According to the invention of this claim 10, since it changes from a control form which a short-circuit current generated to another control form, generating of a short-circuit current can be prevented.

[0028] [Embodiment of the Invention]Hereafter, this invention is explained with reference to drawing 1 thru/or drawing 4 per 1st example at the time of applying to the cooking heater of two lots. The appearance of the cooking heater 20 of a built-in type is shown in drawing 2. In this drawing 2, the pan placing parts 22a, 22b, and 22c are shown on the upper surface of the top plate 21 by three places by printing. Among

these, under the pan placing parts 22a and 22b on either side, the heating coils 23 and 23 (refer to drawing 1) are allocated, respectively, and the Nichrome wire heater which is not illustrated under the central pan placing part 22c is allocated.

[0029]The roaster 24 is allocated in left-hand side by the front part of the cooking heater 20, and the navigational panel 25 is allocated in right-hand side. The final controlling elements 26, such as various kinds of switches and a dial, are formed in this navigational panel 25, and the input setting means slack input setting machine 26a for what is called steam-generated control of the heating coils 23 and 23 is formed in this final controlling element 26. The pans 27 and 27 which are loads are laid in said pan placing parts 22a and 22b.

[0030]Next, electric constitution is explained with reference to drawing 1. Although only the composition which makes one heating coil 23 drive is shown, the circuit for making the two heating coils 23 and 23 and a Nichrome wire heater drive comprises this drawing 1 actually. DC power supply circuit 28 has the composition of having connected the ac input terminal of the full wave rectifier circuit 29 to the commercial alternating current power 30, and having connected the direct-current contact button among both the terminals of the smoothing capacitor 32 via the reactor 31.

[0031]Among both the terminals of the smoothing capacitor 32, the inverter circuit 34 is connected via DC buses 33a and 33b. This inverter circuit 34 connects switching element slack IGBT35a, 35b, the resonance capacitors 36, the above-mentioned heating coil 23, and the free wheel diodes 37a and 37b like a graphic display, and is constituted. That is, between said DC bus 33a and 33b, the arm which consists of switching element slack IGBT35a of a right side and a negative side and 35b is

connected, and the free wheel diodes 37a and 37b are connected to parallel at every IGBT35a and 35b, respectively. One end of the heating coil 23 is connected to the output terminal of this inverter circuit 34, it is connected to DC bus 33b via the resonance capacitors 36, and the resonant circuit 38 is constituted by the other end of that heating coil 23 with the heating coil 23 and the resonance capacitors 36. As for every IGBT35a of the inverter circuit 34, and 35b, a driving signal is given to a gate from the actuator 39.

[0032]The microcomputer 40 as a subject who does drive controlling of the inverter circuit 34, It has composition which equipped the inside with ROM, RAM, etc., drive controlling of IGBT35a and the 35b is carried out according to input power, and it has the function as the drive frequency control means 41 and the driving-pulse-width control means 42. This microcomputer 40 is provided also with the function as the switching means 43. It is for said drive frequency control means 41 changing the drive frequency of IGBT35a and 35b, and the driving-pulse-width control means 42 is for changing the driving pulse width of IGBT35a and 35b.

[0033]The switching circuit 44 changes the output of the drive frequency control means 41, and the output of the driving-pulse-width control means 42, and gives them to the actuator 39. Said input setting machine 26a sets up input power arbitrarily between 3 kW - 50W, as it is for setting up steam-generated slack input power, for example, is shown in drawing 3. The input set value with this input setting machine 26a is given to said switching means 43, the drive frequency control means 41, and the driving-pulse-width control means 42.

[0034]Now, operation of the drive frequency control means 41 in said microcomputer

40, the driving-pulse-width control means 42, and the switching means 43 is explained, referring to drawing 3 and drawing 4. At the time of 3 kW or less, get the drive frequency control means 41 blocked with more than 800W, and an input set value with the input setting machine 26a in the case of a high input field, as an input set value becomes high -- one duty ratio -- drive frequency is raised while it has been fixed (a cycle is shortened) -- it controls like (refer to drawing 4 (a) and (b)).

[0035]At the time of not less than 3 kW, get blocked the driving-pulse-width control means 42 with less than [800W], and an input set value with the input setting machine 26a in a low input area, as an input set value becomes low -- drive frequency -- while it has been fixed, driving pulse width is made small (a dead time is enlarged) -- it controls like (refer to drawing 4 (c) and (d)).

[0036]When an input set value with the input setting machine 26a is more than 800W (high input field), the switching means 43 outputs the selection signal Sa, and it operates the switching circuit 44 so that the control signal a from the drive frequency control means 41 may be received. the drive frequency control means 41 controls drive frequency according to the input set value beyond 800W, and outputs the control signal a, and the switching means 43, At the time below 800W, the selection signal Sb is outputted, and the switching circuit 44 is operated so that the control signal b from the driving-pulse-width control means 42 may be received. The driving-pulse-width control means 42 controls driving pulse width according to the input set value below 800W, and outputs the control signal b.

[0037]according to such an example -- input power, since the drive frequency control means 41 and the driving-pulse-width control means 42 are changed according to the

input power set up with the input setting machine 26a in this case, That is, since the drive frequency control means 41 and the driving-pulse-width control means 42 perform input adjustment, an input can be continuously changed from a low area to a high area, without a short-circuit current occurring without frequency becoming high too much.

[0038]According to this example, the drive frequency control by the drive frequency control means 41 performs input adjustment in a high input field, and the driving-pulse-width control by the driving-pulse-width control means 42 is made to perform input adjustment in a low input area. In this, since drive frequency control will take charge of a high input field, unlike the case where it takes charge from a high input field to a low input area, it can change the input in a high input field continuously good, without generating a short-circuit current. Since a low input area is taken charge of by driving-pulse-width control, an input can be lowered continuously and it is not necessary to make drive frequency high in this case by making it small one by one from proper driving pulse width.

[0039]Drawing 5 shows the 2nd example, and in this example, the snubber circuit 45 provided with the snubber capacitor 45a to IGBT35a is connected, and it differs from the 1st example in that the snubber circuit 46 provided with the snubber capacitor 46a to IGBT35b is connected. According to this example, the standup of the voltage of IGBT35a and 35b can be eased by the snubber circuits 45 and 46, respectively, generating and switching loss of a noise can be suppressed, and it can contribute to improve efficiency. And also in the composition provided with such snubber circuits 45 and 46, since a high input field is taken charge of by drive frequency control and a low input area is taken charge of by driving-pulse-width control, good input adjustment can

be continuously aimed at from the high input field to a low input area. As a snubber circuit, it may constitute from a snubber capacitor and resistance. One snubber circuit may be sufficient to IGBT of plurality (two).

[0040] Drawing 6 shows the 3rd example, replaces it with the switching means 43 in the 2nd example in this example, and it differs in that the input detecting means 51 was established. The input current detecting signal by a current detecting means although not illustrated besides the setting input from the input setting machine 26a in this input detecting means, Input power is detected in response to an inverter current detecting signal or the voltage detection signal of the resonance capacitors 36 by the voltage detection means which is not illustrated, and when the sensing input electric power becomes shown in drawing 3 in the 1st example with the same value, the same control as the 1st example is performed.

[0041] That is, when the above-mentioned sensing input electric power is more than 800W, the selection signal Sa is outputted and the switching circuit 44 is operated to control signal a reception of the drive frequency control means 41. as, as for the drive frequency control means 41, sensing input electric power becomes high at this time -- one duty ratio -- drive frequency is raised while it has been fixed (a cycle is shortened) -- it controls like (refer to drawing 4 (a) and (b)). When the above-mentioned sensing input electric power is less than [800W], the selection signal Sb is outputted and the switching circuit 44 is operated to control signal b reception of the driving-pulse-width control means 42. It controls to make driving pulse width small with drive frequency regularity as, as for the driving-pulse-width control means 42, an input set value becomes low at this time (refer to drawing 4 (c) and (d)).

[0042] Drawing 7 thru/or drawing 9 show the 4th example, and the following point differs from the 3rd example. That is, the drive frequency control and the driving-pulse-width control means 52 which comprised a drive frequency control means and a driving-pulse-width control means as one unit as a control means which controls a low input area are established.

[0043] When sensing input electric power is less than [800W], the selection signal Sb is outputted and the switching circuit 44 is operated to control signal b reception of drive frequency control and the driving-pulse-width control means 52. At this time, drive frequency control and the driving-pulse-width control means 52 control driving pulse width so that drive frequency also raises one by one with a small fence, as sensing input electric power becomes low (refer to drawing 9 (c) and (d)).

[0044] Since not only driving-pulse-width control but drive frequency control performs input adjustment in a low input area according to this example, if drive frequency is set up according to driving pulse width, fine control will be attained without making frequency high. It replaces with drive frequency control and the driving-pulse-width control means 52 of one unit provided with the drive frequency control means and the driving-pulse-width control means, and may be made to perform drive frequency control and driving-pulse-width control simultaneously using the drive frequency control means 41 and the driving-pulse-width control means 42. In short, any may be sufficient as whether it has a function of a drive frequency control means and a driving-pulse-width control means in one unit, or it has in an independent unit.

[0045] Drawing 10 thru/or drawing 12 show the 5th example, and the following point differs from the 3rd example. That is, the drive frequency control and the driving-pulse-

width control means 53 which comprised a drive frequency control means and a driving-pulse-width control means as one unit as a control means which controls a high input field are established.

[0046]When sensing input electric power is more than 800W, the control signal a of drive frequency control and driving-pulse-width control means 53 and others is received by the switching circuit 44. Drive frequency control and the driving-pulse-width control means 53 raise drive frequency, and makes driving pulse width small as compared with the case of the same one duty ratio further as sensing input electric power becomes high at this time. (Refer to drawing 12 (a) and (b)).

[0047]It becomes possible to perform still finer input adjustment control, without according to this example, generating a short-circuit current in a high input field, since input adjustment in a high input field is performed not only by drive frequency control but by driving-pulse-width control. Above-mentioned driving pulse width may be enlarged as compared with the case of the same one duty ratio.

[0048]Drawing 13 thru/or drawing 15 show the 6th example. In this example, the place which takes charge of input adjustment in a high input field by drive frequency control and the driving-pulse-width control means 54, and took charge of input adjustment in a low input area by the drive frequency control means 55 differs from the 3rd example. That is, drive frequency is also changed small, enlarging driving pulse width as a sensing input is improved, when sensing input electric power is more than 800W. (Refer to drawing 15 (a) and (b)). It controls to raise drive frequency one by one as it is considered as fixed duty ratio and sensing input electric power becomes low, when sensing input electric power is less than [800W] (refer to drawing 15 (c) and (d)).

[0049]It becomes possible to perform still finer input adjustment control, without according to this example, generating a short-circuit current in a high input field, since the input adjustment in a high input field is taken charge of by driving-pulse-width control and drive frequency control is also performed in addition to this. And since the input adjustment in a low input area is taken charge of by drive frequency control, an input can be continuously lowered by setting driving pulse width as the duty ratio which does not become large, and raising drive frequency, without making frequency high.

[0050]Drawing 16 thru/or drawing 18 show the 7th example, and the place which took charge of input adjustment in a high input field by the driving-pulse-width control means 56 differs from the 6th example. That is, by frequency regularity, it changes so that driving pulse width may be enlarged, as a sensing input is improved, when sensing input electric power is more than 800W. (Refer to drawing 18 (a) and (b)).

[0051]Since the input adjustment in a high input field is taken charge of by driving-pulse-width control according to this example, unlike the case where from a high input field to a low input area is performed by driving-pulse-width control, input adjustment in the high input field by the impossible pulse width which is not can be performed.

[0052]Drawing 19 thru/or drawing 21 show the 8th example, and the place which took charge of the low input area by drive frequency and the driving-pulse-width control means 57 differs from the 7th example of the above in this example. That is, when sensing input electric power is less than [800W], drive frequency is made high as a sensing input becomes low, and also driving pulse width is changed small. (Refer to drawing 21 (c) and (d)).

[0053]Drawing 22 shows the 9th example. In this example, it differs from the 3rd

example in that the inverter means for stopping 58 was established. That is, the inverter means for stopping 58 detects the place where a rise or descent of sensing input electric power passes the threshold 800W, outputs an inverter stop signal to the actuator 39 temporarily, and stops inverter operation. Therefore, since operation of an inverter circuit is stopped, the change to drive frequency control of the drive frequency control means 41 and driving-pulse-width control of the driving-pulse-width control means 42 is performed. Since according to this example drive frequency control and driving-pulse-width control are changed, operation of the inverter circuit 34 is stopped and it carries out, operation of the inverter circuit 34 is not made to change suddenly, and fear of breakage of IGBT35a and 35b disappears.

[0054]When a short-circuit current detection means to detect the short-circuit current of the inverter circuit 34 is formed and a short-circuit current is detected by this short-circuit current detection means, it may be made to perform the change to drive frequency control of the drive frequency control means 41, and driving-pulse-width control of the driving-pulse-width control means 42. If it does in this way, since it will change from the control form which the short-circuit current generated to another control form, generating of a short-circuit current can be prevented. It may be made to stop operation of the inverter circuit 34 before this change.

[0055]Drawing 23 shows the 10th example and it differs from the 1st example in that the microwave oven was shown as an inverter cooking device in this example. That is, the high frequency transformer 60 for driving the magnetron 59 is formed instead of the heating coil. Also in this example, the same effect as the 1st example can be acquired.

[0056]Drawing 24 shows the 11th example and the following point differs from the 3rd

example (drawing 6). That is, the snubber circuit 46 is formed to IGBT35b, and a resonance-capacitors voltage phase detection means 61 to detect the voltage phase of the resonance capacitors 36 is formed. The microcomputer 40 is equipped with the function as the phase contrast setting-out means 62, the phase difference detecting means 63, the comparison-operation means 64, the drive frequency control means 65, and the driving-pulse-width control means 66.

[0057]The phase contrast setting-out means 62 sets up phase contrast by the sensing input from the input detecting means 51. The 1st signal S1 that the output voltage of the inverter circuit 34 correlates is given to the phase difference detecting means 63, and the 2nd signal S2 that a phase correlates with the output current of the inverter circuit 34 outputted from the resonance-capacitors voltage phase detection means 61 is given, and those phase contrast is detected. Instructions are taken out to the drive frequency control means 65 so that the phase-difference-detection value of this phase difference detecting means 63 and the phase contrast preset value of said phase contrast setting-out means 62 may be given to the comparison-operation means 64, may compare both values by this comparison-operation means 64 and may become equal.

[0058]The drive frequency control means 65 outputs the drive frequency control signal according to the instructions from the comparison-operation means 64, and gives it to the driving-pulse-width control means 66. At this time, the driving-pulse-width control means 66 adjusts driving pulse width according to the sensing input of said input detecting means 51.

[0059]Since it changes into directly suitable frequency from the comparison result by the comparison-operation means 64 according to this 11th example, It can prevent driving

on the frequency conditions which become capacitive [the impedance of the resonant circuit 38], and can drive now on the frequency which always serves as resonance frequency or inductive impedance, and derivation of a loss can be controlled as much as possible. And since pulse width is adjusted according to an input, considering it as the frequency, input adjustment broad from a high input field to a low input area can be performed.

[0060]This invention is not limited to each above-mentioned example, but may be changed as follows. It may be made to perform input adjustment by drive frequency control of a drive frequency control means on the frequency which turns into more than the resonance frequency of an inverter circuit. When it does in this way, an inverter circuit can be operated in an inductive situation and there is no short-circuit current generating by the reverse recovery characteristic of a free wheel diode. As a snubber circuit, it may constitute from a capacitor and resistance. The threshold 800W of a high input field and a low input area may be changed suitably. Two or more thresholds are provided and it may be made to perform drive frequency control, driving-pulse-width control, and control by the both suitably in each input area further again.

[0061]

[Effect of the Invention]This invention can carry out continuation variable from a high input to a low input, without drive frequency's becoming high too much, or a short-circuit current flowing so that clearly from the above explanation.

CLAIMS

[Claim(s)]

[Claim 1]An inverter cooking device which is provided with the following and characterized by performing input adjustment by said drive frequency control means and a driving-pulse-width control means.

A bridge type inverter circuit which generates high-frequency power based on having a heating coil or a high frequency transformer, a capacitor for resonance, and a switching element, and carrying out switching driving of this switching element.

A drive frequency control means which controls drive frequency of said switching element.

A driving-pulse-width control means which controls driving pulse width of said switching element.

[Claim 2]The inverter cooking device according to claim 1 or 2 providing one or more snubber circuits to two or more switching elements of an inverter circuit.

[Claim 3]The inverter cooking device according to claim 1 or 2 drive frequency control by a drive frequency control means performing input adjustment in a high input field, and performing input adjustment in a low input area by driving-pulse-width control by a driving-pulse-width control means.

[Claim 4]Drive frequency control by a drive frequency control means performs input adjustment in a high input field, and input adjustment in a low input area, The inverter cooking device according to claim 1 or 2 carrying out by driving-pulse-width control by a driving-pulse-width control means, and drive frequency control by a drive frequency

control means.

[Claim 5]Driving-pulse-width control by a driving-pulse-width control means and drive frequency control by a drive frequency control means perform input adjustment in a high input field, and input adjustment in a low input area, The inverter cooking device according to claim 1 or 2 carrying out by driving-pulse-width control by a driving-pulse-width control means.

[Claim 6]Driving-pulse-width control by a driving-pulse-width control means and drive frequency control by a drive frequency control means perform input adjustment in a high input field, and input adjustment in a low input area, The inverter cooking device according to claim 1 or 2 carrying out by drive frequency control by a drive frequency control means.

[Claim 7]The inverter cooking device according to claim 1 or 2 driving-pulse-width control by a driving-pulse-width control means performing input adjustment in a high input field, and performing input adjustment in a low input area by drive frequency control by a drive frequency control means.

[Claim 8]Driving-pulse-width control by a driving-pulse-width control means performs input adjustment in a high input field, and input adjustment in a low input area, The inverter cooking device according to claim 1 or 2 carrying out by driving-pulse-width control by a driving-pulse-width control means, and drive frequency control by a drive frequency control means.

[Claim 9]The inverter cooking device according to claim 1 or 2 performing it since a change to drive frequency control of a drive frequency control means and driving-pulse-width control of a driving-pulse-width control means stops operation of an inverter

circuit.

[Claim 10] When a short-circuit current detection means to detect a short-circuit current of an inverter circuit is formed and a short-circuit current is detected by this short-circuit current detection means, The inverter cooking device according to any one of claims 1 to 10 performing a change to drive frequency control of a drive frequency control means, and driving-pulse-width control of a driving-pulse-width control means.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] The electric constitution figure showing the 1st example of this invention

[Drawing 2] Appearance perspective view

[Drawing 3] The figure showing the relation between an input and a drive controlling gestalt

[Drawing 4] The figure showing the situation of turning on and off of IGBT according to LA in each input in drawing 3, LB, LC, and LD

[Drawing 5] The drawing 1 equivalent figure showing the 2nd example of this invention

[Drawing 6] The drawing 1 equivalent figure showing the 3rd example of this invention

[Drawing 7] The drawing 1 equivalent figure showing the 4th example of this invention

[Drawing 8] Drawing 3 equivalent figure

[Drawing 9] Drawing 4 equivalent figure

[Drawing 10] The drawing 1 equivalent figure showing the 5th example of this invention

[Drawing 11] Drawing 3 equivalent figure

[Drawing 12] Drawing 4 equivalent figure

[Drawing 13]The drawing 1 equivalent figure showing the 6th example of this invention

[Drawing 14]Drawing 3 equivalent figure

[Drawing 15]Drawing 4 equivalent figure

[Drawing 16]The drawing 1 equivalent figure showing the 7th example of this invention

[Drawing 17]Drawing 3 equivalent figure

[Drawing 18]Drawing 4 equivalent figure

[Drawing 19]The drawing 1 equivalent figure showing the 8th example of this invention

[Drawing 20]Drawing 3 equivalent figure

[Drawing 21]Drawing 4 equivalent figure

[Drawing 22]The drawing 1 equivalent figure showing the 9th example of this invention

[Drawing 23]The drawing 1 equivalent figure showing the 10th example of this invention

[Drawing 24]The drawing 6 equivalent figure showing the 11th example of this invention

[Drawing 25]The drawing 1 equivalent figure showing a conventional example

[Drawing 26]The figure showing the situation of turning on and off of a switching

element

[Drawing 27]A circuit diagram for the current of each part in an inverter circuit and

voltage to be shown

[Drawing 28]The figure showing the situation of the current of the inverter circuit at the

time of switching

[Drawing 29]Switching, current, the wave form chart showing the situation of the change

of potential

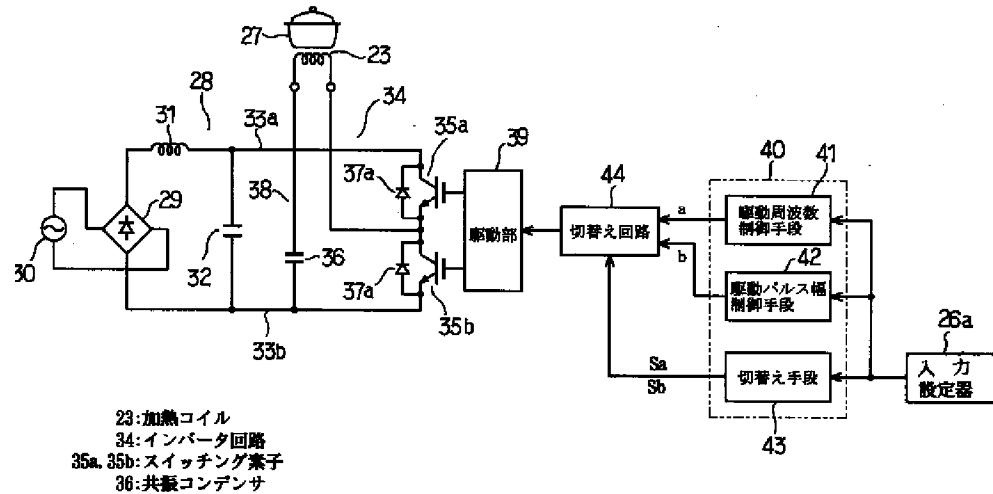
[Description of Notations]

A heating coil and 26a for 23 an input setting machine and 28 a DC power supply circuit

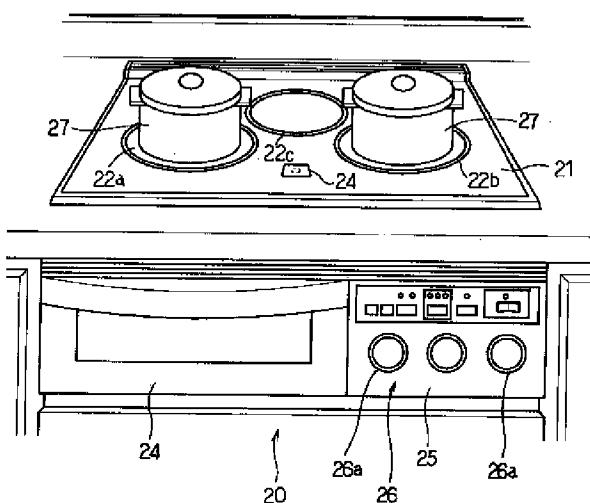
and 34 An inverter circuit, IGBT (switching element) and 36 35a and 35b Resonance capacitors, A free wheel diode and 40 37a and 37b A microcomputer, 41 a drive frequency control means and 42 a driving-pulse-width control means and 43 A switching means, 45a and 46a a snubber capacitor, and 45 and 46 a snubber circuit and 51 An input detecting means, 52, 53, 54, and 57 -- drive frequency control and a driving-pulse-width control means (a drive frequency control means.) a driving-pulse-width control means and 55 -- a drive frequency control means and 56 -- a resonance-capacitors voltage phase detection means and 62 show a phase contrast setting-out means, 63 shows a phase difference detecting means, and, as for an inverter means for stopping and 61, a driving-pulse-width control means and 58 show a comparison-operation means 64.

DRAWINGS

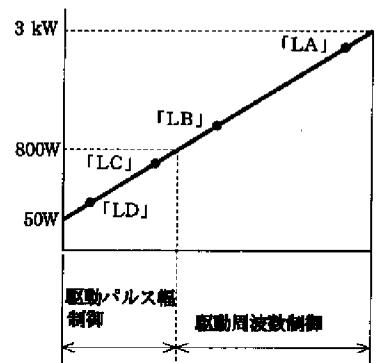
[Drawing 1]



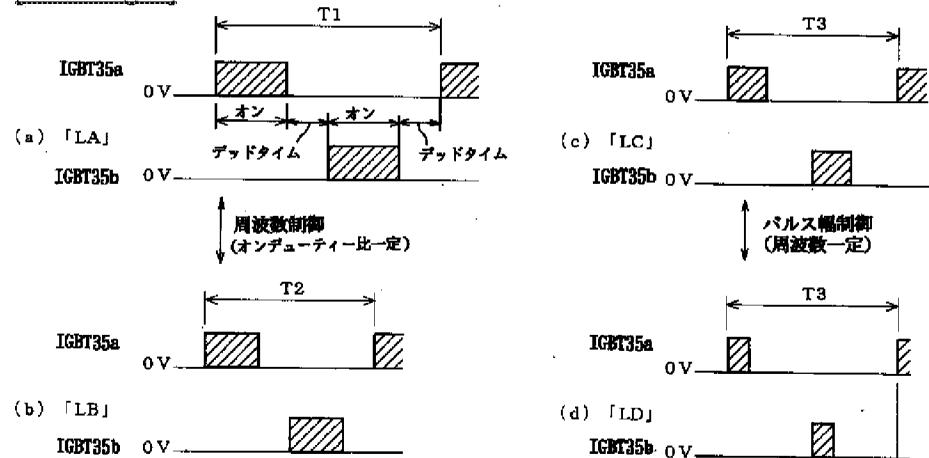
[Drawing 2]



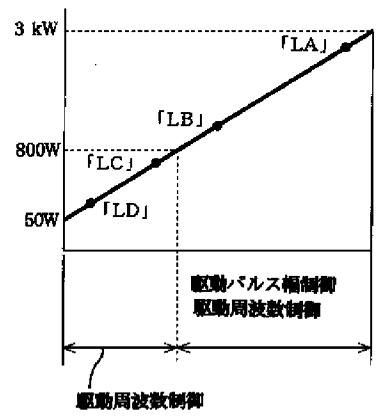
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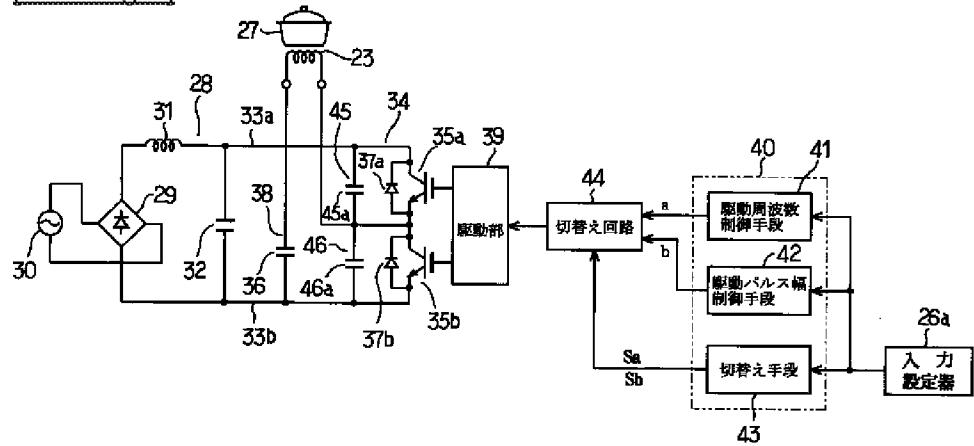
[Drawing 4]



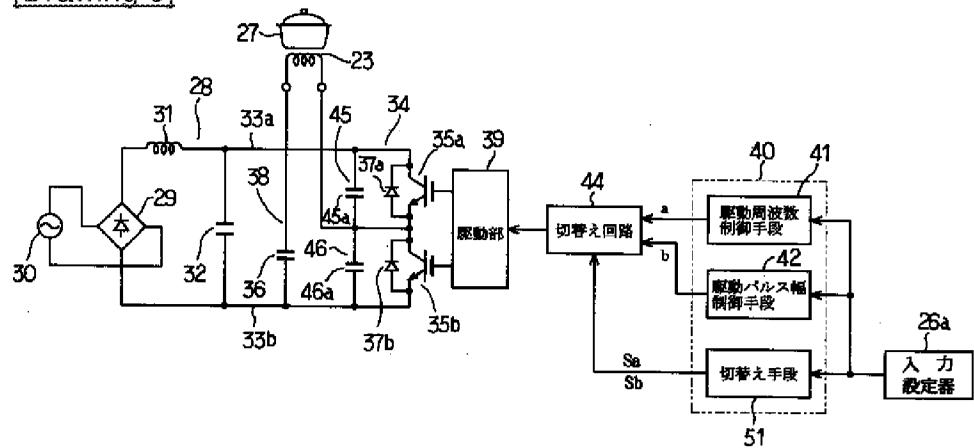
[Drawing 14]



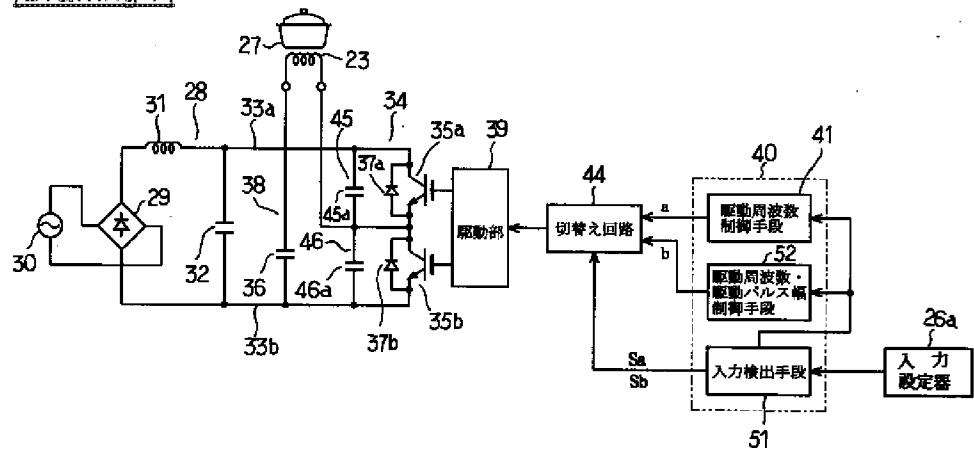
[Drawing 5]



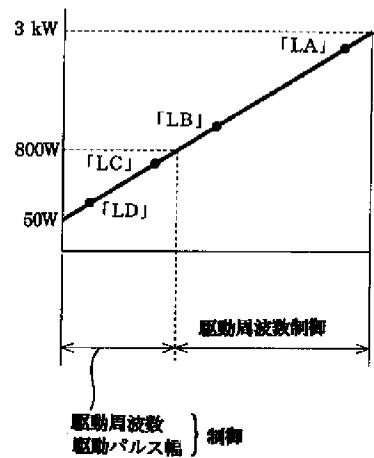
[Drawing 6]



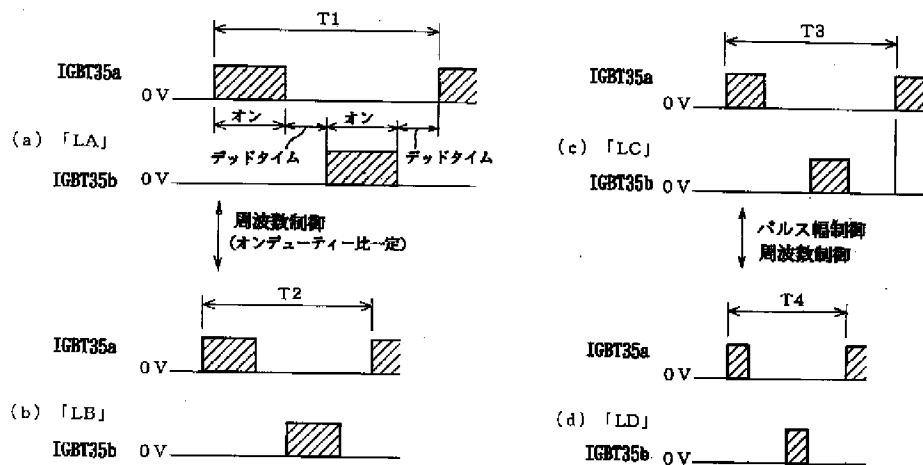
[Drawing 7]



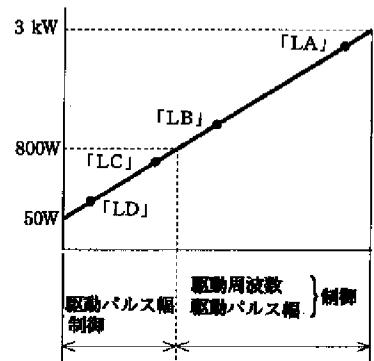
[Drawing 8]



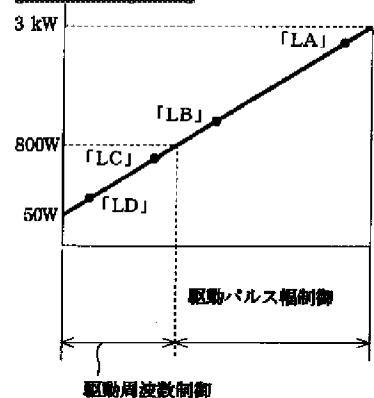
[Drawing 9]



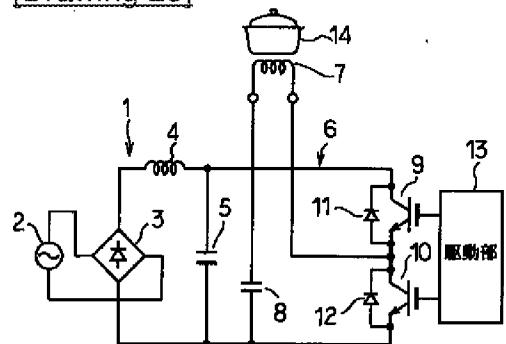
[Drawing 11]



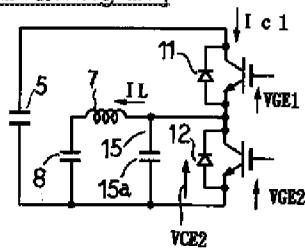
[Drawing 17]



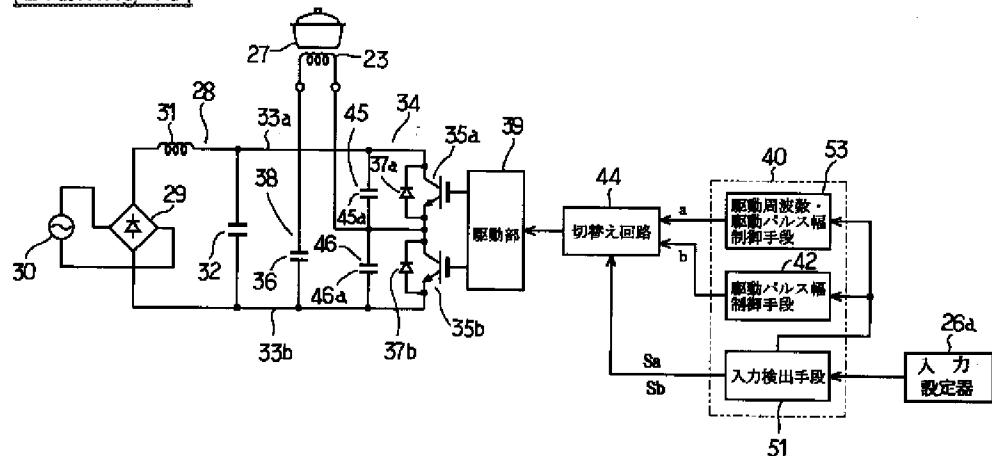
[Drawing 25]



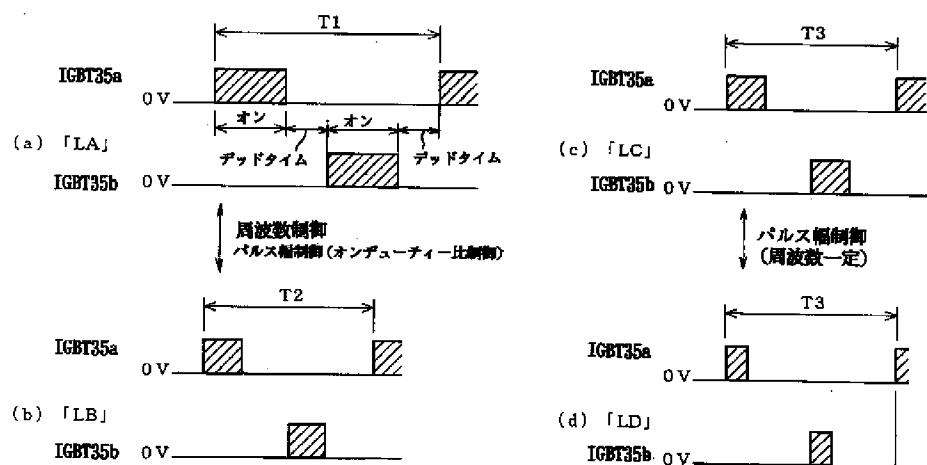
[Drawing 27]



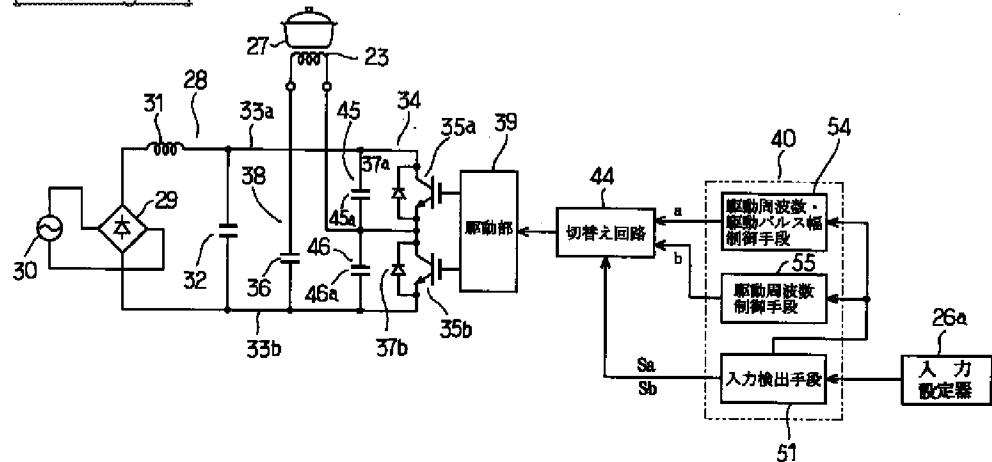
[Drawing 10]



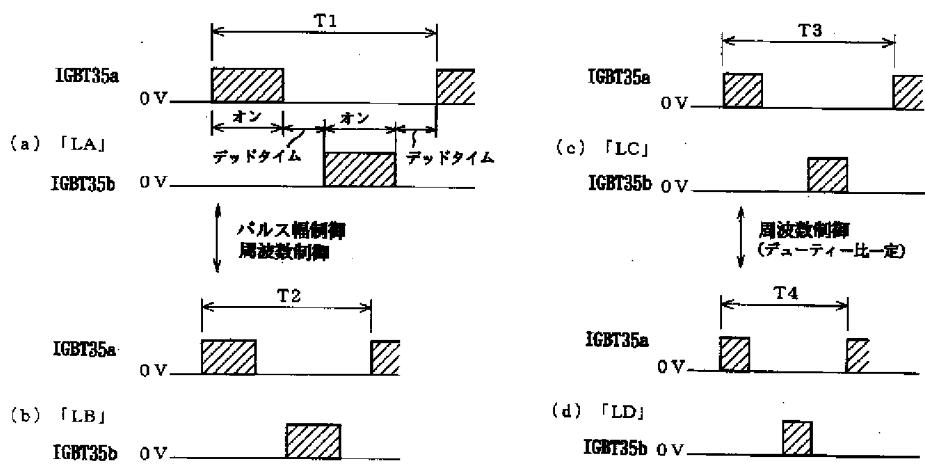
[Drawing 12]



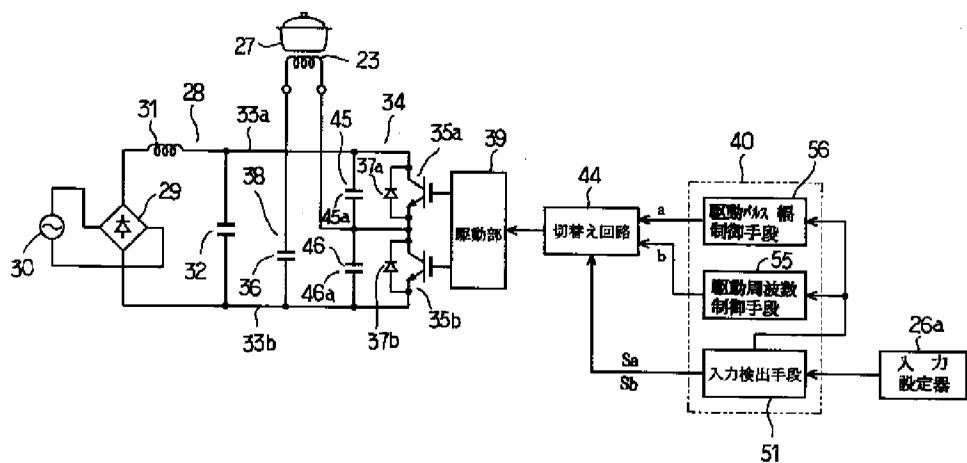
[Drawing 13]



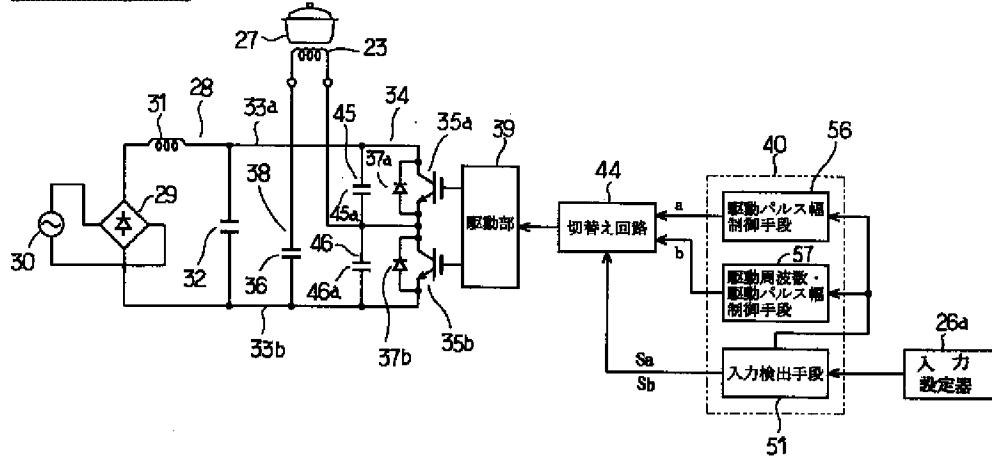
[Drawing 15]



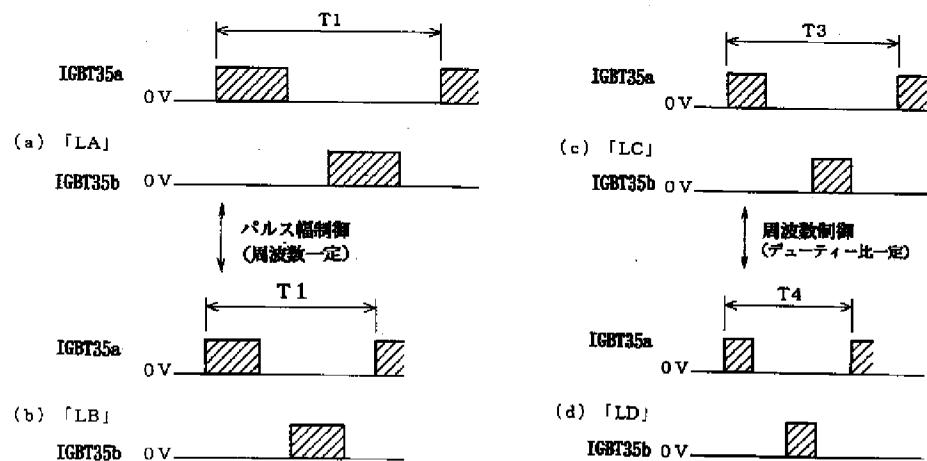
[Drawing 161]



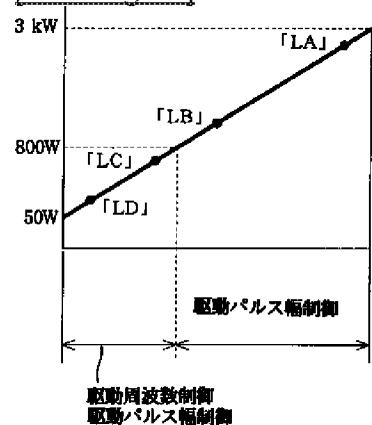
[Drawing 19]



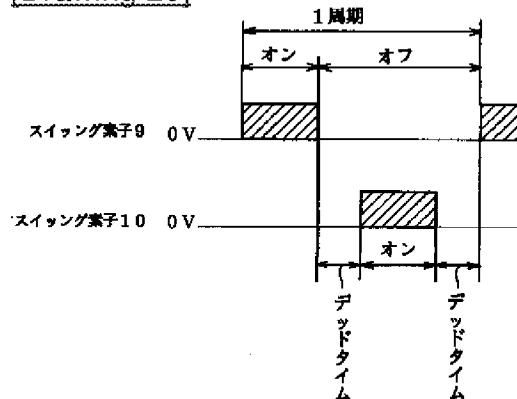
[Drawing 18]



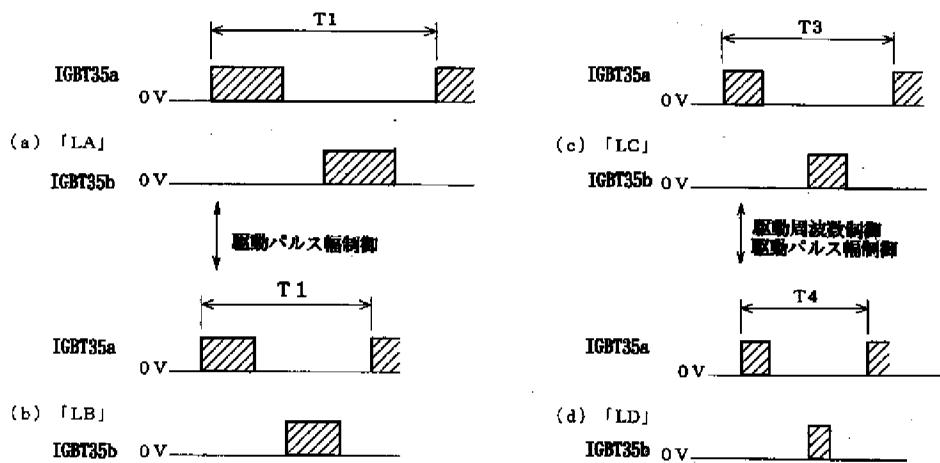
[Drawing 20]



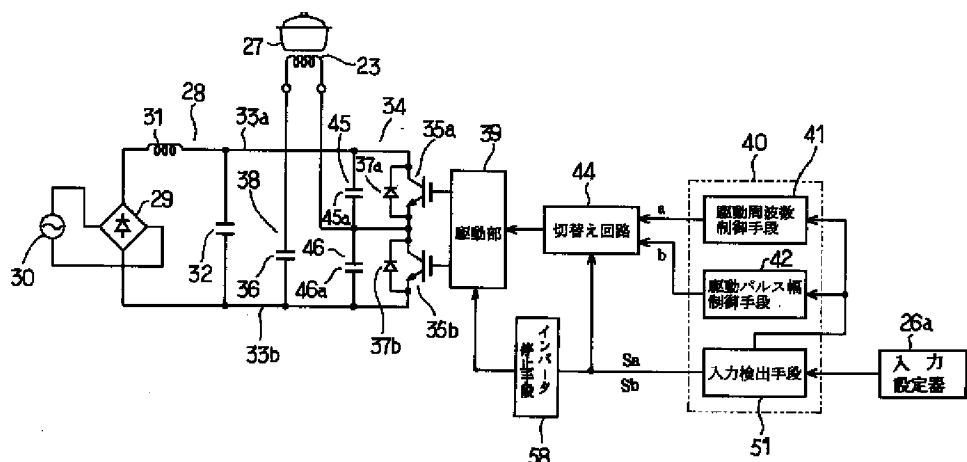
[Drawing 26]



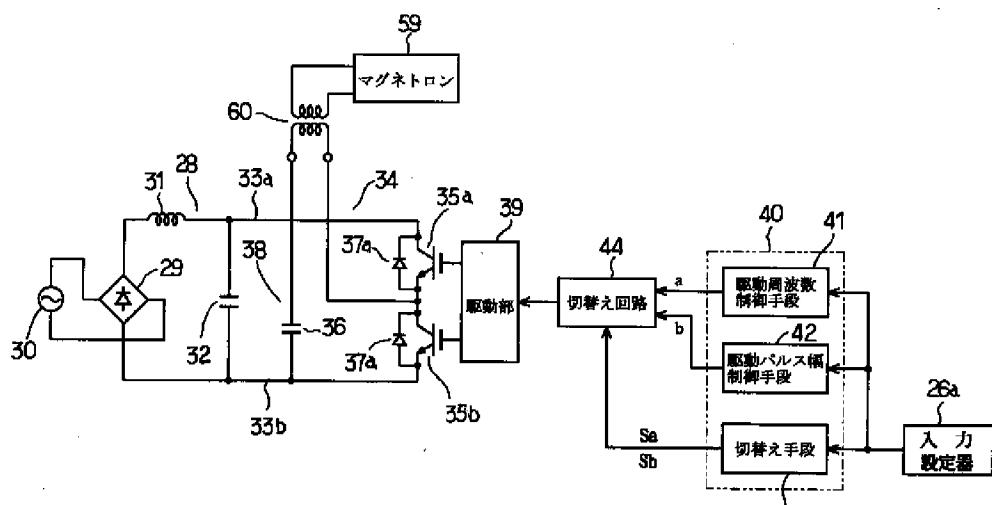
[Drawing 21]



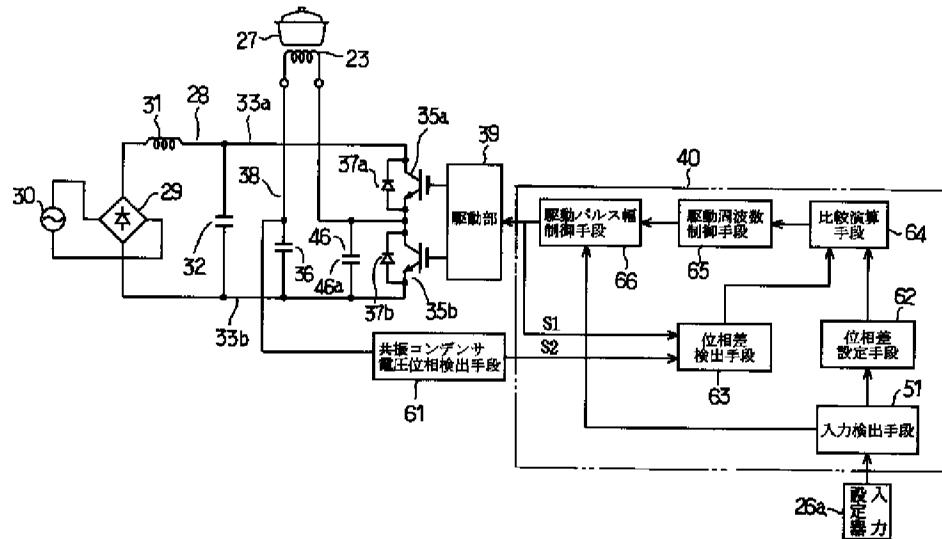
[Drawing 22]



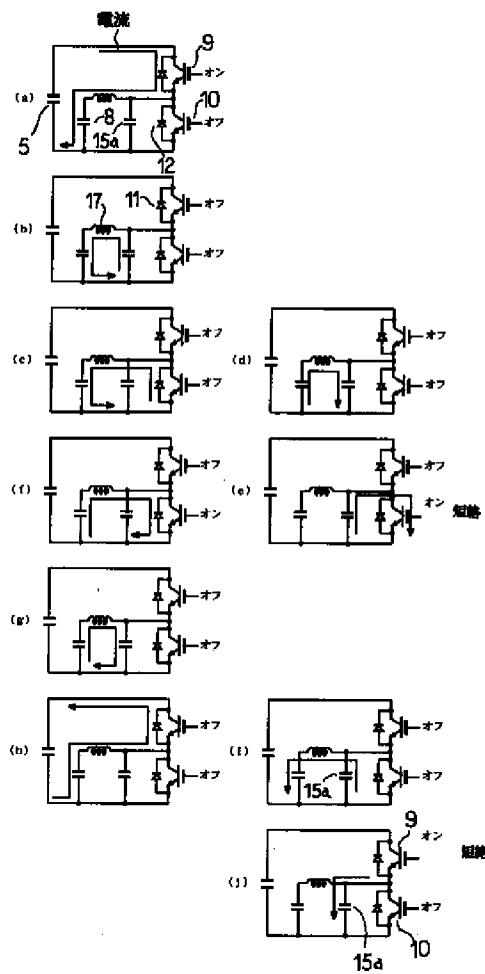
[Drawing 23]



[Drawing 24]



[Drawing 28]



[Drawing 29]

